Space Weather Technical Forecast

Issued on Wednesday, 17 November 2021 at 01:00 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance of G1/Minor Geomagnetic Storms on day 1 (17th). Chance of Active Electron Fluence through days 1-4 (17th-20th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was very low with three benign sunspots on the visible disc and no significant flare activity. The newly emerged region in the northeast has been numbered AR2897 and analysed as an Hsx/ alpha. AR2894 and AR2896 in the southeastern and southwestern quadrants respectively, are both classified as mature Hsx/Alpha regions. A CME has been observed off the southwest limb, it will be analysed for any Earth-directed component once more imagery becomes available. No other Earth-directed CMEs have been observed on available imagery.

Solar Wind / Geomagnetic Activity: Solar wind speeds have been elevated to strong through the period averaging around 600km/s. The peak was 658 km/s at 16/2147UTC. This is due to a connection with the High Speed Stream from negative Coronal Hole 19. The density has been average or slightly above average, reaching a peak of 12 ppcc early in the period. The IMF was around 15nT early in the period but for most of the time has been weak at or below 8nT. The north-south component, Bz, started the period close to +11nT, though quickly fell back to weakly positive or neutral through the period. The phi angle was mostly negative (towards the Sun). Geomagnetic activity was Active (Kp4) from 16/0001-0600 UTC. Unsettled (Kp3) from 16/0600-1200 UTC, after which it was Quiet (Kp2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at background levels. The high energy electron flux (greater than 2 MeV) was predominantly background below 100 pfu. The associated 24-hour integrated fluence remained below the Active threshold (1e8 integrated pfu), on a steady trend, with 2.24e6 integrated pfu recorded at 16/2359 UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly very low, with a slight chance of C-class flares from the three sunspot regions.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs, though a CME off the southwest limb is waiting to be analysed. Solar wind speeds are expected to remain elevated or strong through day 1 (17th Nov) then declining through days 2 to 4 (18th-20th). Geomagnetic activity is expected to be mainly Unsettled or Active, with a slight chance of G1/Minor Storms at first on day 1. Unsettled periods are then expected on day 2 (18th), with a chance of Active intervals. Mainly Quiet to Unsettled conditions are then expected from day 3 (19th), with a decreasing chance of Active intervals.
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to be at background levels. The high energy electron flux (greater than 2 MeV) is expected to rise in response to recent solar wind enhancement, as the winds ease during day 1 (17th Nov), becoming persistently high for the remainder of the period. The corresponding 24-hour electron fluence is expected to rise in response during day 1 (17th), likely increasing above the Active (1e8 integrated pfu) threshold late on day 1 or during day 2 (17th-18th).

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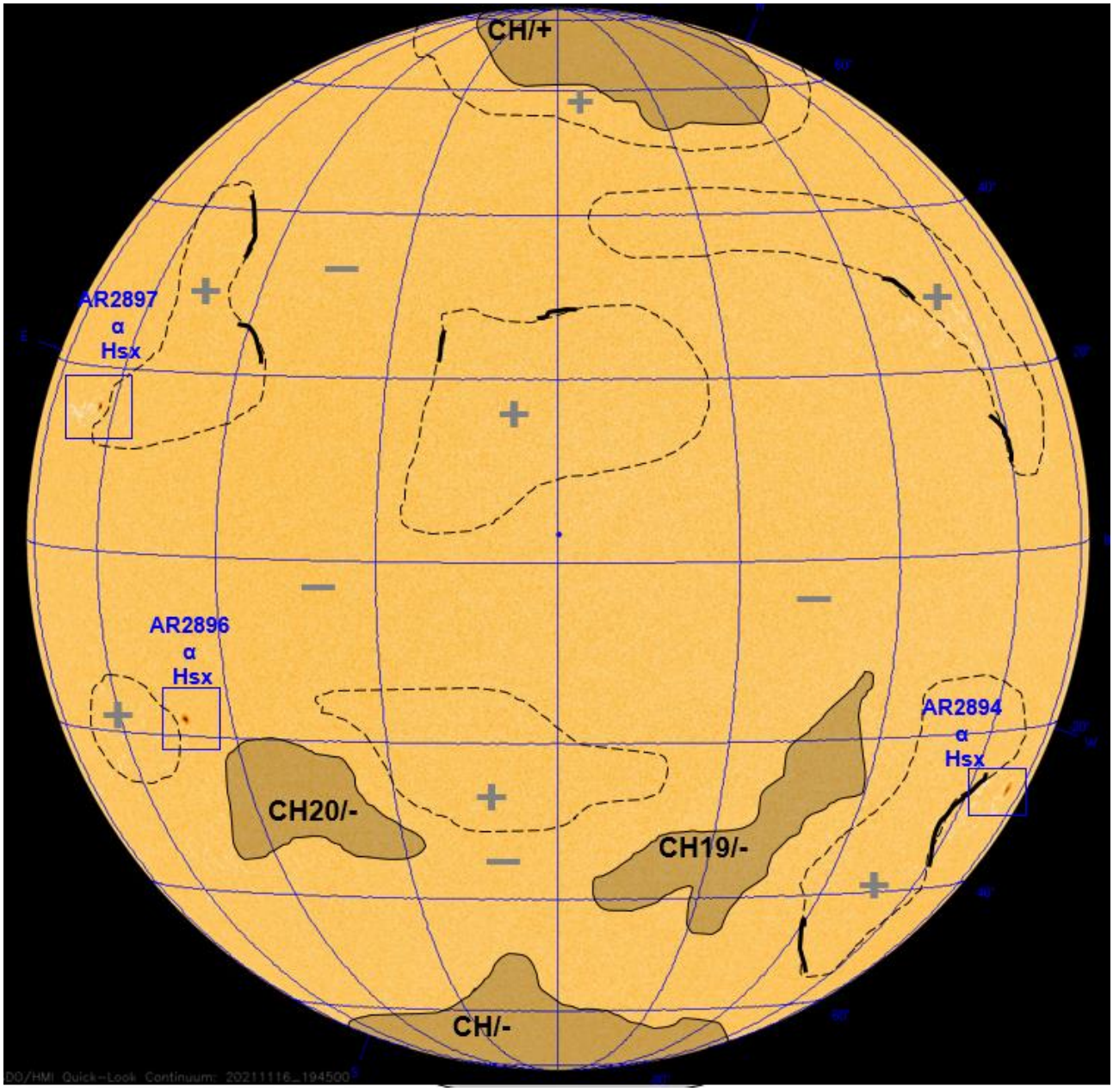
Figure 1. Solar Analysis Valid 16/2000 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs in the forecast period.

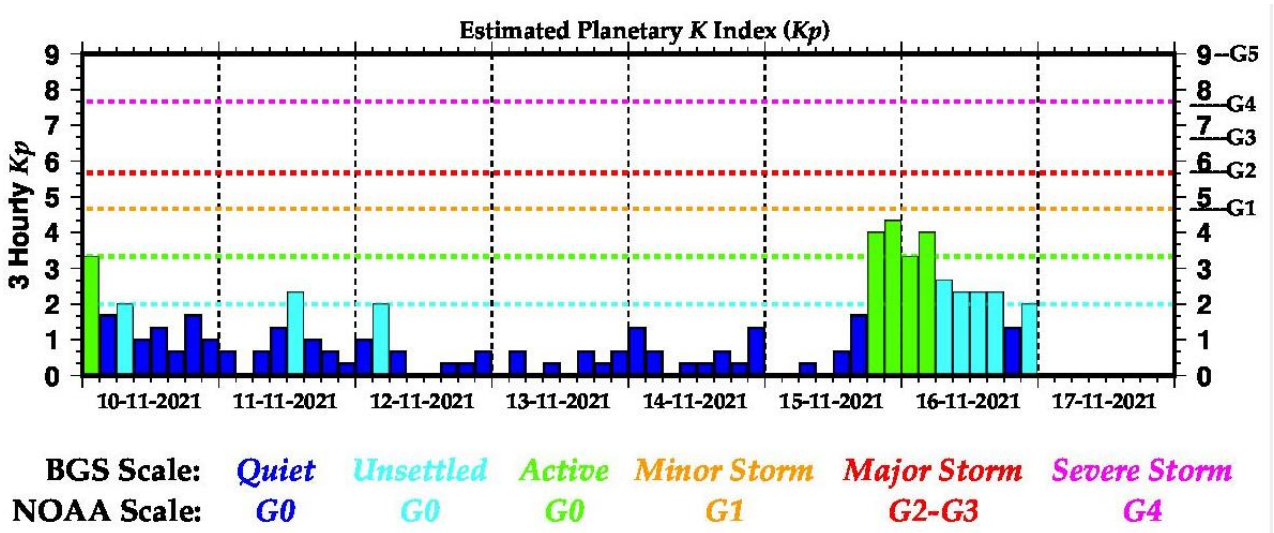
Solar wind speeds are elevated or strong due to a connection to the high speed stream from coronal hole 19. The high speed stream is expected to continue at a similar level at first on day 1 (17th) before beginning to ease later and into day 2 (18th) before declining to background on day 3 (19th).

Geomagnetic activity is expected to be mainly Unsettled or Active, with a slight chance of G1/Minor Storms at first on day 1. Unsettled periods are then expected on day 2 (18th), with a chance of Active intervals. Mainly Quiet to Unsettled conditions are then expected from day 3 (19th), with a decreasing chance of Active intervals.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	60	20	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections- Nil

Figure 2: Estimated Planetary K index (Kp) from BGS



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Radio Blackouts - X-Ray Flares:

There are three sunspot regions on the visible disc, all of which are currently benign alpha regions. AR2894 and AR2896 in the southwestern and southeastern quadrants respectively, are both mature and benign Hsx/alpha regions, with no signs of development. New region AR2897 in the northeastern quadrant is also classified as an Hsx/alpha region, with correspondingly low risk of flare activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	1	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at background levels during the previous 24 hours, and is currently forecast to remain at this level through the period.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2MeV) as measured by GOES-16 are currently at background levels, likely due to a mixture of radiation belt distortion due to the strong high speed stream, and a redistribution of electrons in the belts due to the recent geomagnetic enhancements. As a result, background levels are expected to continue at first through day 1. However later on day 1 into day 2 an increase in electron flux coinciding with the decrease in solar wind speeds and geomagnetic activity is expected, leading to a sustained period of high electron flux values.

Electron fluence is forecast to increase in line with the forecast increase in the electron flux. REFM forecasts that fluence will reach the Active (1e8 integrated pfu) either late on day 1 or day 2, with this trend broadly accepted. Perhaps easing back on day 4 (20th).

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	**≥ 2 MeV ≥ $1x10^{8}$**	No	20	70	70	60
Very Active	**≥ 2 MeV ≥ $1x10^{9}$**	No	1	5	5	1

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